C2 syringe; and a reaction step for heating said sealed syringe to cause said composition to undergo an addition reaction in a binding region where cross-linking density is low, thereby producing a low cross-linking density gel in said syringe allowing said close adherence to said optical fibres.

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Cancel claims 3-5, 6, 10 and 12-16, without prejudice.

## REMARKS

Claim 1 has been amended to adopt the Examiner's suggestion relating to the low cross linking gel. Claim 1 has further been amended to combine the limitations of claim 6, claim 6 being indicated as containing allowable subject matter in Paper 12. The remaining claims of this application with the exception of claims 7, 8 and 9, have been canceled. Pages 5,7 and 8 have been amended also to include the suggestions made by the Examiner. Claims 1 and 7-9 remain in this application and stand for examination. Reexamination and reconsideration are requested in view of today's amendments and the comments made hereinafter.

### Objection to the specification

Applicant appreciates the consideration of the Examiner relating to the idiom of the present specification. In particular, the cross-linking step referred to by the Examiner and relating to the meaning of "cross-linking" as set out on page 2 of the action (Paper 12) has been adopted in today's response in claim 1 and on page 7 of the disclosure.

The Examiner also objects to page 7 of the specification and claim 1 which each describes a "compounding" technique. This word "compounding" has been deleted on page 7 of the disclosure and in claim 1 as amended. In addition, the applicant has adopted the Examiner's suggestion relating to the synthesizing step set out in the disclosure at page 8. The Examiner's comments set out in paragraph (ii) on page 4 of Paper 12 have also been incorporated.

Objection to claims 7,11,13 and 15

The Examiner raises objections to claims 7,11,13 and 15. These claims have now been canceled in today's response.

Objection to claims 1 and 3-16 for indefiniteness

The Examiner rejects claims 1 and 3-16 under 35 U.S.C. 112, first paragraph. Specifically, the Examiner objects to the statements relating to the compounding or adjusting step.

The assumption of the Examiner relating to the compounding/adjusting step is noted and is correct. A siloxane polymer is selected wherein the gel is selected with the desired qualities. However, claim 1 has been amended to remove the objectionable phrase and has further been amended by combining that claim with claim 6. Claims 3-5 and 10-16 have been deleted in today's response.

<u>Rejection of claims 1, 3-5 and 10-14 for anticipation</u>

The Examiner rejects claims 1, 3-5 and 10-14 under 35 U.S.C. 102(b) as being anticipated by Filas et al United States Patent 5,266,352 and further in view of Ikeno United States Patent 5,599,894.

By today's amendment, these claims have now been canceled.

<u>Indication of allowable subject matter</u>

The Examiner's indication of allowable subject matter in respect of claims 6-9 is noted with appreciation. By today's amendment, claim 6 has been combined with claim 1 and claims 7-9 have been rewritten in accordance with the Examiner's suggestions. It is now submitted that these claims should be in condition for allowance.

The Examiner's comments relating to the Cammons and Szentesi et al, Stoy et al references is noted.

<u>Priority documentation</u>

The Examiner advises that applicant has not filed certified copies of the priority Japanese applications.

The case is a national phase of the PCT application and the applicant has confirmed to the undersigned that a request for issuing a certified copy of each of the Japanese priority

applications was properly filed on the PCT application. Accordingly, the United States Patent and Trademark Office must have received the necessary priority applications from the World Intellectual Property Organization. Confirmation of this by the Examiner would be appreciated.

A marked up version of the specification and claims accompanies this response and is entitled "VERSION WITH MARKINGS TO INDICATE CHANGES MADE".

In view of the above, reexamination and reconsideration is requested. It is now believed that with the removal of the objections and rejections on this case and the cancellation of the claims not indicated as being in allowable form, that this case should be in condition for allowance. Allowance of claims 1 and 7-9 is respectfully solicited.

I HEREBY CERTIFY THAT THIS DOCUMENT AND/OR FEE IS BEING DEPOSITED WITH THE U.S. POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO: COMMISSIONER OF PATENTS AND TRADEMARKS, UNITED STATES PATENT AND TRADEMARK OFFICE, WASHINGTON, D.C. 20231 ON Aug 27, 2002

By:

JOHN R. UREN
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Respectfully submitted,

INAGAKI, Takeo et al

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Date: August 27, 2002

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comprises:

a compounding step for adjusting a flexible silicone gel material to have a specified refractive index

a combining step for synthesizing a composition by adding a cross-linking agent to the flexible silicone gel material adjusted in the compounding step,

a filling step for filling the composition into a syringe,

a sealing step for sealing the syringe, and

a reaction step for heating the sealed syringe to cause the composition to undergo an addition reaction in a binding region where cross-linking density is low, thereby producing a low cross-linking density gel in the syringe.

In the inventive method, the syringe is sealed by mounting a cap in the sealing step.

In the inventive method, the syringe is mounted in a dispenser for dispensing a predetermined amount of the low cross-linking-density gel by replacing the cap mounted on the syringe by a nozzle after the low cross-linking-density gel is produced in the syringe.

Further, an inventive low cross-linking-density gel is produced by causing a flexible silicone gel material adjusted to have a specified refractive index to undergo an addition reaction to cross-link in a binding region where cross-linking density is low.

In the inventive gel, the specified refractive index is set substantially equal to the refractive index of cores of optical fibers to be connected.

In the inventive gel, the flexible silicone gel material is a polyorganosiloxane having vinyl groups at its ends.

In the inventive gel, a cross-linking agent is added prior to the cross-linking

The inventors of the pr sent application studied the structures of various elastic materials and viscous materials during the development of a material which satisfies the above requirements and, in their study, directed their attentions to a macromolecule having a three-dimensional reticulated structure insoluble in a solvent and a gel structure which is a swollen material of such a macromolecule. Consequently, they established a compounding technique according to which a transparent flexible silicone gel material selected as a base material among synthetic gels was gelatinized at a low cross-linking density, thereby forming a low cross-linking density gel (gel-fluid intermediate) which has a shape retaining property, which is a characteristic of a gelatinous elastic material, while having fluidity.

As a result of repeated devotion and efforts, the inventors completed a compounding technique for producing a low cross-linking-density gel which satisfies all of the aforementioned requirements and found out that this material was optimal as a material used for the connection of end faces of optical fibers. In other words, by merely providing the thus produced low cross-linking-density gel between the end faces of the optical fibers, a loss of light at the joint portion when light was transmitted from one optical fiber to the other could be effectively suppressed and conducting efficiency was remarkably improved.

In this invention, the low cross-linking-density gel is produced as follows.

Adjusting the refractive index by adding a primary agent and making cross-links by adding a binding agent is known to those skilled in the art. A transparent fl xible silicone gel material thereby is caused to undergo an additional reaction in a binding agent where cross-linking is low, with the result that the low cross-linking density gel having a viscosity and a minimum flexibility can be obtained. As a result of the additional reaction that provides a gel having a low cross-link density,

free hydrogen atoms are advantageously absent since they are fully consumed during the r action.

In the above addition reaction, a polyorganosiloxane containing covalently bound hydrogen atoms is added as a cross-linking agent to a polyorganosilozane containing vinyl groups at its ends, which is a component of the primary agent, and cross-linking takes place in the presence of a platinum, catalyst.

A range of the cross-linking density was specified by an amount of the cr ss-linking agent to be added, and a final cross-linking density could be substantially precisely controlled. The cross-linked binding region of the low cross-linking-density gel is in the range of 30% to 10% of the theoretical quantity for the primary agent to be fully cross-linked.

If the gel is produced beyond the above cross-linked binding agent, it displays properties more similar to those of an elastic material as the ratio of the cross-linking agent increases. As a result, the gel loses its fluidity and comes to p ssess a breakage point, which is not preferable. On the other hand, if the gel is cross-linked to a lesser degree than is recommended above, the portion of the vinyl functional polyorganosiloxane that remains unreacted has an increased degree of freedom. As a result, the gel becomes considerably fluid and creeping flow peculiar to silicone takes place, which are both not preferable.

The refractive index of the low cross-linking-density gel can be adjusted to a value substantially equal to those of various optical fibers by adjusting the refractive index of a transparent silicone oligomer a primary agent in advance. Thus, a loss of light caused by the reflection and diffusion of light due to a difference in refractive index between the cores of the optical fibers to be connected and the low cross-linking-density gel can be suppressed to a minimum

VERSION WITH MARKINGS TO INDICATE CHANGES MADE

1. A method for producing a flexible and low density cross-linking gel for connecting optical fibers having a refractive index, said method comprising:

~~a compounding step for~~ adjusting the refractive index of a flexible silicone gel material to that generally equal to the refractive index of said optical fibers to be connected, and .

by cross-linking said silicone gel material to an extent such that a gel having a low degree of

a reaction step for causing the ~~flexible silicone gel material adjusted in said compounding step to cross-link in~~ a ~~binding region where~~ cross-linking density is ~~low, thereby producing~~ produced for ~~said low cross-linking density gel for~~ closely adhering to said optical fibers~~.~~ ; and wherein said adjustment step and said reaction step are carried out in a clean room

7. A method for producing a low cross linking density gel used for connecting and for adhering to optical fibers, said method comprising:

~~a compounding step for~~ adjusting the refractive index of a flexible silicone gel material to that of ~~the refractive index of~~ said optical fibers to be connected,

a synthesizing step for synthesizing a composition by adding a cross-linking agent to said flexible silicone gel

material ~~adjusted in said compounding step~~;

a filling step for filling said composition into a syringe;

a sealing step for sealing said syringe, and

a reaction step for heating said sealed syringe to cause said composition to undergo an addition reaction in a binding region where cross-linking density is low, thereby producing a low cross-linking density gel in said syringe allowing said close adherence to said optical fibers.

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compris s:

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a ~~synthesizing~~ combining step for synthesizing a composition by adding a cross-linking agent to the flexible silicone gel material adjusted in the compounding step,

a filling step for filling the composition into a syringe,

a sealing step for sealing the syringe, and

a reaction step for heating the sealed syringe to cause the composition to undergo an addition reaction in a binding region where cross-linking density is low, thereby producing a low cross-linking-density gel in the syringe.

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In the inventive method, the syringe is mounted in a dispenser for dispensing a predetermined amount of the low cross-linking-density gel by replacing the cap mounted on the syringe by a nozzle after the low cross-linking-density gel is produced in the syringe.

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~~that provides a gel having a low cross-linking density~~

free hydrogen atoms are advantageously absent since ~~a total amount of active hydrogen atoms contribute to the reaction~~ they are fully consumed during the reaction.

In the above addition reaction, a polyorganosiloxane containing covalently bound hydrogen atoms is added as a cross-linking agent to a polyorganosiloxane containing vinyl groups at its ends, which is a component of the primary agent, and cross-linking takes place in the presence of a platinum catalyst.

A range of the cross-linking density was specified by an amount of the cross-linking agent to be added, and a final cross-linking density could be substantially precisely controlled. The cross-linked binding ~~agent~~ region of the low cross-linking-density gel is in the range of 30% to 10% of the theoretical ~~equivalent of the polyorganosiloxane containing covalently bound hydrogen atoms~~.

If the gel is produced beyond the above cross-linked binding agent, it displays properties more similar to those of an elastic material as the ratio of the cross-linking agent increases. As a result, the gel loses its fluidity and comes to possess a breakage point, which is not preferable. On the other hand, if the gel is ~~produced below the above cross-linked binding agent, the primary agent which is not cross-linked~~ has an increased degree of freedom. As a result, the gel becomes considerably fluid and creeping flow peculiar to silicone takes place, which are both not preferable.

The refractive index of the low cross-linking-density gel can be adjusted to a value substantially equal to those of various optical fibers by adjusting the refractive index of a transparent silicone oligomer as a primary agent in advance. Thus, a loss of light caused by the r flection and diffusion of light due to a difference in refractive ind x between the cores of the optical fibers to be connected and the low cross-linking-density gel can be suppressed to a minimum